ABSTRACT

[0088] Spatial derivatives are computed. In one method, gradients are determined from data in an acoustic domain rather than a Cartesian or display coordinate domain. The gradients determined from data in the acoustic domain are then transformed to the Cartesian coordinate or display screen domain. For example, a matrix function representing the spatial relationship between the acoustic domain and the Cartesian coordinate domain transforms the coordinates. As a result, spatial gradients in the Cartesian system are provided where acoustic domain data is being processed. In another method for volume rendering or three-dimensional imaging, a gradient is calculated from data in the display or screen domain. Data from a reconstructed 3D Cartesian coordinate grid or data in an acoustic domain is resampled to ray lines. The ray lines correspond to the display domain as compared to an arbitrary Cartesian coordinate format. The gradients are calculated from the resampled data in the screen domain. When resampling on data in an acoustic domain, gradient computation prior to the resampling may require transformation as discussed above. To avoid the transformation, the gradients are determined after resampling. By calculating the gradients after resampling, interpolation of gradient information as part of the resampling is avoided or minimized. The gradient calculation is then performed using data in the display coordinate space (i.e., screen domain) without requiring further random memory accesses. In yet another method, the number of computation and interpolations for gradient calculation is reduced by performing shading prior to resampling along ray lines to the screen domain. The gradients are calculated and the voxel data in the acoustic or 3D grid Cartesian coordinate formats are altered or weighted as a function of the shading. The shaded data is then resampled to the ray lines. For example, the shading values are computed from data in an acoustic domain and applied to the data in the acoustic domain. The data is then ray cast or interpolated to ray lines without prior scan conversion.